

- ☐ Tentative Specification
- ☐ Preliminary Specification
- ☒ Approval Specification

MODEL NO.: V290BJ1

SUFFIX: PE1

|                                                                                      |           |
|--------------------------------------------------------------------------------------|-----------|
| Customer:                                                                            |           |
| CONFIRMED BY                                                                         | SIGNATURE |
| <u>Name / Title</u>                                                                  | <u></u>   |
| APPROVED BY                                                                          | SIGNATURE |
| <u>Name / Title</u>                                                                  | <u></u>   |
| Note<br>Please return 1 copy for your confirmation with your signature and comments. |           |

|                 |              |             |
|-----------------|--------------|-------------|
| Approved By     | Checked By   | Prepared By |
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## REVISION HISTORY

| Version  | Date          | Page(New) | Section | Description                                  |
|----------|---------------|-----------|---------|----------------------------------------------|
| Ver. 2.0 | May. 15, 2012 | All       | All     | The approval specification was first issued. |

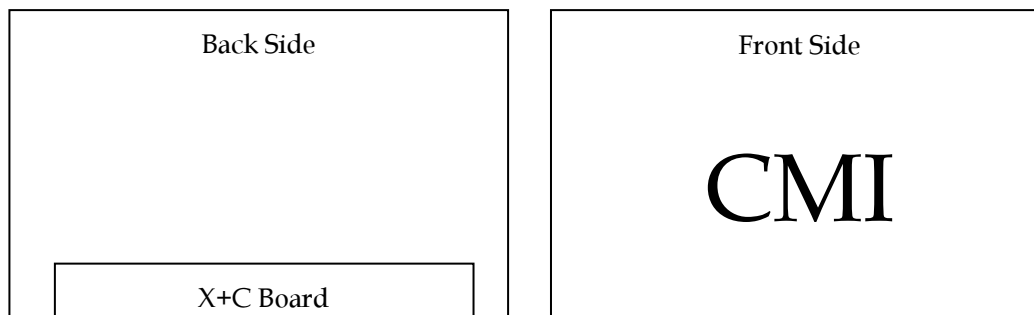
## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V290BJ1-PE1 is a 29" TFT Liquid Crystal Display product with driver ICs and 1ch-LVDS interface. This product supports 1366 × 768 HDTV format and can display 16.7M colors (8-bit). The backlight unit is not built in.

### 1.2 FEATURES

| CHARACTERISTICS ITEMS             | SPECIFICATIONS                                                                                                                        |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Screen Diagonal [in]              | 29                                                                                                                                    |
| Pixels [lines]                    | 1366 × 768                                                                                                                            |
| Active Area [mm]                  | 631.092(H) × 354.816(V) (29" diagonal)                                                                                                |
| Sub-Pixel Pitch [mm]              | 0.154(H) × 0.462(V)                                                                                                                   |
| Pixel Arrangement                 | RGB Vertical Stripe                                                                                                                   |
| Weight [g]                        | 727 Typ. (g)                                                                                                                          |
| Physical Size [mm]                | 647.14 × 411.516 × 2.3 Typ.                                                                                                           |
| Display Mode                      | Transmissive Mode / Normally Black                                                                                                    |
| Contrast Ratio                    | Typ.3000:1<br>(Typical value measure by CMI's Module)                                                                                 |
| Glass thickness (Array / CF) [mm] | 0.5 / 0.5                                                                                                                             |
| Viewing Angle (CR>20)             | +88/-88(H), +88/-88(V) Typ. (CR≥20)<br>(Typical value measure by CMI's module)                                                        |
| Color Chromaticity                | R = (0.650, 0.328)<br>G = (0.277, 0.596)<br>B = (0.132, 0.115)<br>W = (0.299, 0.353)<br>* Please refer to "color chromaticity" in 7.2 |
| Cell Transparency [%]             | 5.4%                                                                                                                                  |
| Polarizer Surface Treatment       | Anti-Glare coating (Haze 3.5%)                                                                                                        |
| Rotation Function                 | Unachievable                                                                                                                          |
| Display Orientation               | Signal input with "CMI"                                                                                                               |

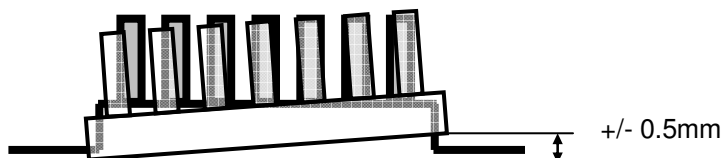


### 1.3 MECHANICAL SPECIFICATIONS

| Item                            | Min.                                                                                                           | Typ. | Max. | Unit | Note |
|---------------------------------|----------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Weight                          | -                                                                                                              | 727  | -    | g    | -    |
| I/F connector mounting position | The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal. |      |      |      | (2)  |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Connector mounting position



## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol | Value |      | Unit | Note                        |
|-------------------------------|--------|-------|------|------|-----------------------------|
|                               |        | Min.  | Max. |      |                             |
| Storage Temperature           | TST    | -20   | +60  | °C   | (1)<br>With CMI Module      |
| Operating Ambient Temperature | TOP    | 0     | 50   | °C   | (1), (2)<br>With CMI Module |

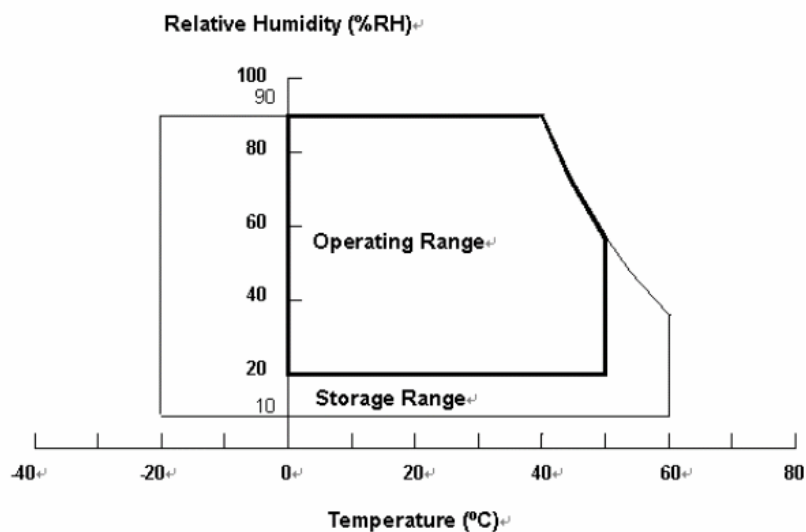
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40^\circ\text{C}$ ).

(b) Wet-bulb temperature should be  $39^\circ\text{C}$  Max. ( $T_a > 40^\circ\text{C}$ ).

(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to  $65^\circ\text{C}$  with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over  $65^\circ\text{C}$ . The range of operating temperature may degrade in case of improper thermal management in final product design.



## 2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

Recommended Storage Condition: With shipping package.

Recommended Storage temperature range:  $25\pm 5\text{ }^{\circ}\text{C}$

Recommended Storage humidity range:  $50\pm 10\%\text{RH}$

Recommended Shelf life: a month

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT LCD MODULE

| Item                 | Symbol | Value |      | Unit | Note |
|----------------------|--------|-------|------|------|------|
|                      |        | Min.  | Max. |      |      |
| Power Supply Voltage | VCC    | -0.3  | 13.5 | V    | (1)  |
| Logic Input Voltage  | VIN    | -0.3  | 3.6  | V    |      |

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.



### 3. ELECTRICAL CHARACTERISTICS

#### 3.1 TFT LCD OPEN CELL

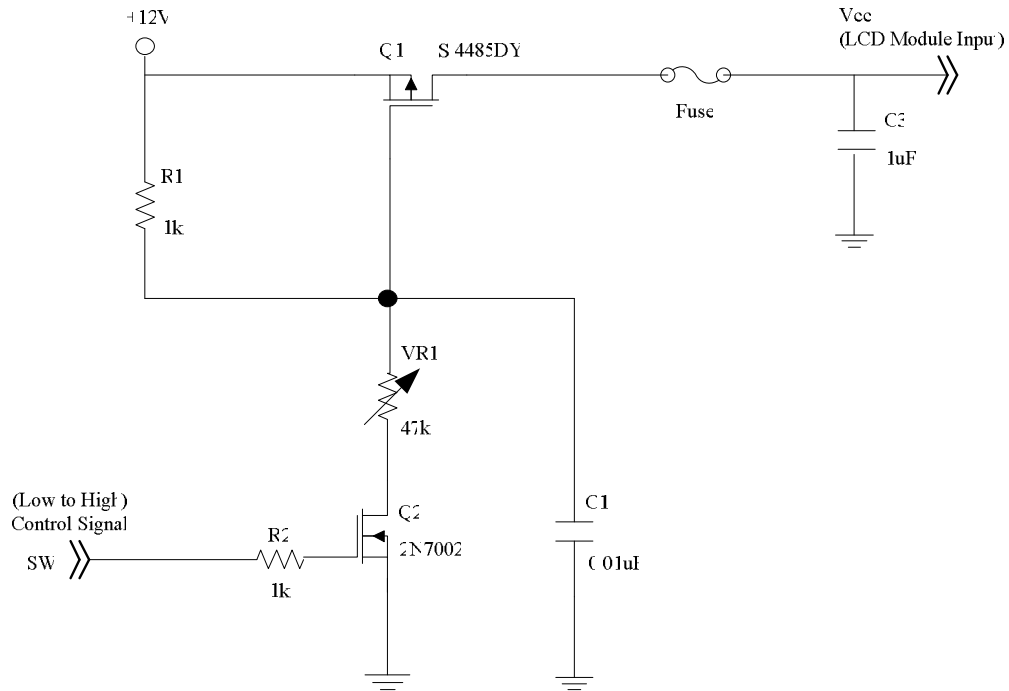
(Ta = 25 ± 2 °C)

| Parameter            |                                           | Symbol            | Value |      |      | Unit | Note |
|----------------------|-------------------------------------------|-------------------|-------|------|------|------|------|
|                      |                                           |                   | Min.  | Typ. | Max. |      |      |
| Power Supply Voltage |                                           | V <sub>CC</sub>   | 10.8  | 12   | 13.2 | V    | (1)  |
| Rush Current         |                                           | I <sub>RUSH</sub> | —     | —    | 3.9  | A    | (2)  |
| Power consumption    | White Pattern                             | P <sub>T</sub>    | —     | 5.04 | 6.72 | W    | (3)  |
|                      | Black Pattern                             | P <sub>T</sub>    | —     | 3.12 | 4.32 |      |      |
|                      | Horizontal Stripe                         | P <sub>T</sub>    | —     | 5.28 | 6.96 |      |      |
| Power Supply Current | White Pattern                             | P <sub>T</sub>    | —     | 0.42 | 0.56 | A    |      |
|                      | Black Pattern                             | P <sub>T</sub>    | —     | 0.26 | 0.36 |      |      |
|                      | Horizontal Stripe                         | P <sub>T</sub>    | —     | 0.44 | 0.58 |      |      |
| LVDS interface       | Differential Input High Threshold Voltage | V <sub>LVTH</sub> | +100  | —    | +300 | mV   | (4)  |
|                      | Differential Input Low Threshold Voltage  | V <sub>LVTL</sub> | -300  | —    | -100 | mV   |      |
|                      | Common Input Voltage                      | V <sub>CM</sub>   | 1.0   | 1.2  | 1.4  | V    |      |
|                      | Differential input voltage (single-end)   | V <sub>ID</sub>   | 200   | —    | 600  | mV   |      |
|                      | Terminating Resistor                      | R <sub>T</sub>    | —     | 100  | —    | ohm  |      |
| CMOS interface       | Input High Threshold Voltage              | V <sub>IH</sub>   | 2.7   | —    | 3.3  | V    |      |
|                      | Input Low Threshold Voltage               | V <sub>IL</sub>   | 0     | —    | 0.7  | V    |      |

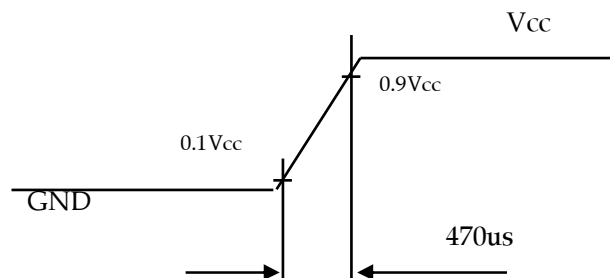
Note (1) The module should be always operated within the above ranges.

The ripple voltage should be controlled under 10% of V<sub>CC</sub> (Typ.).

Note (2) Measurement condition :



Vcc rising time is 470us



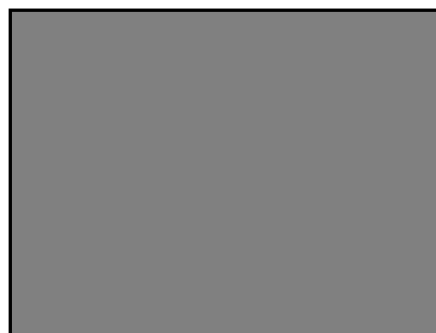
Note (3) The specified power supply current is under the conditions at  $V_{cc} = 12\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern

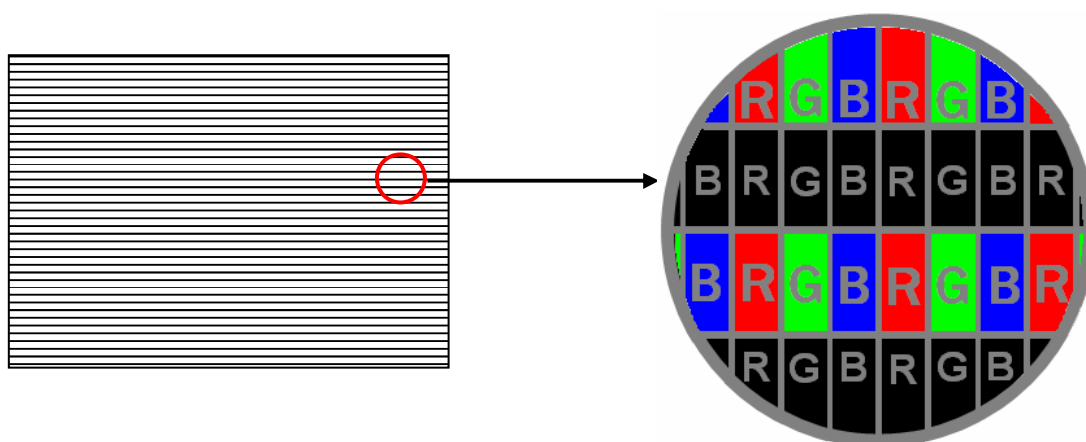


Active Area

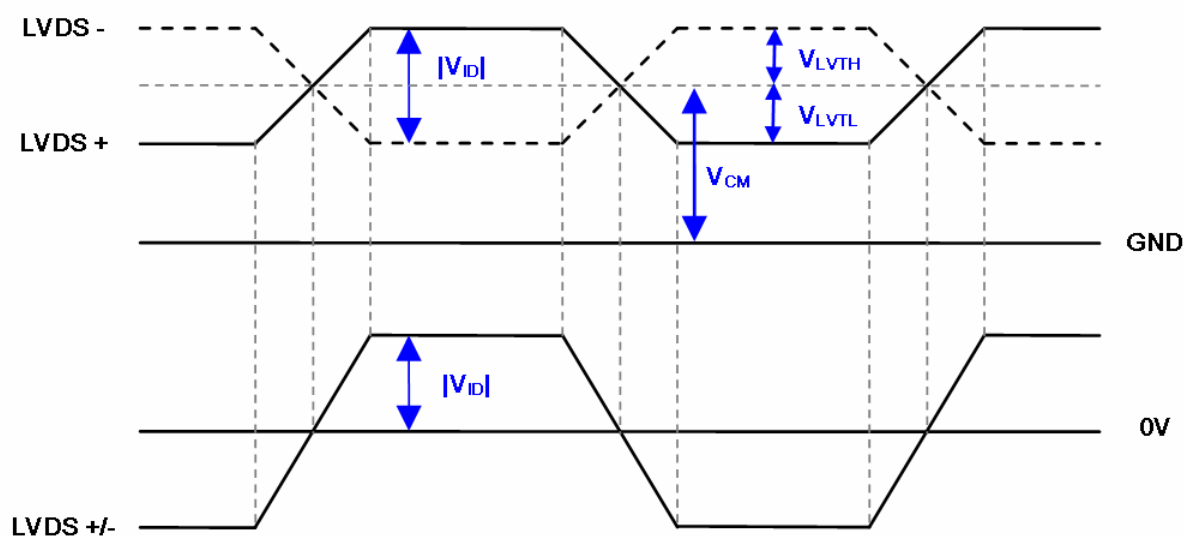
b. Black Pattern



Active Area

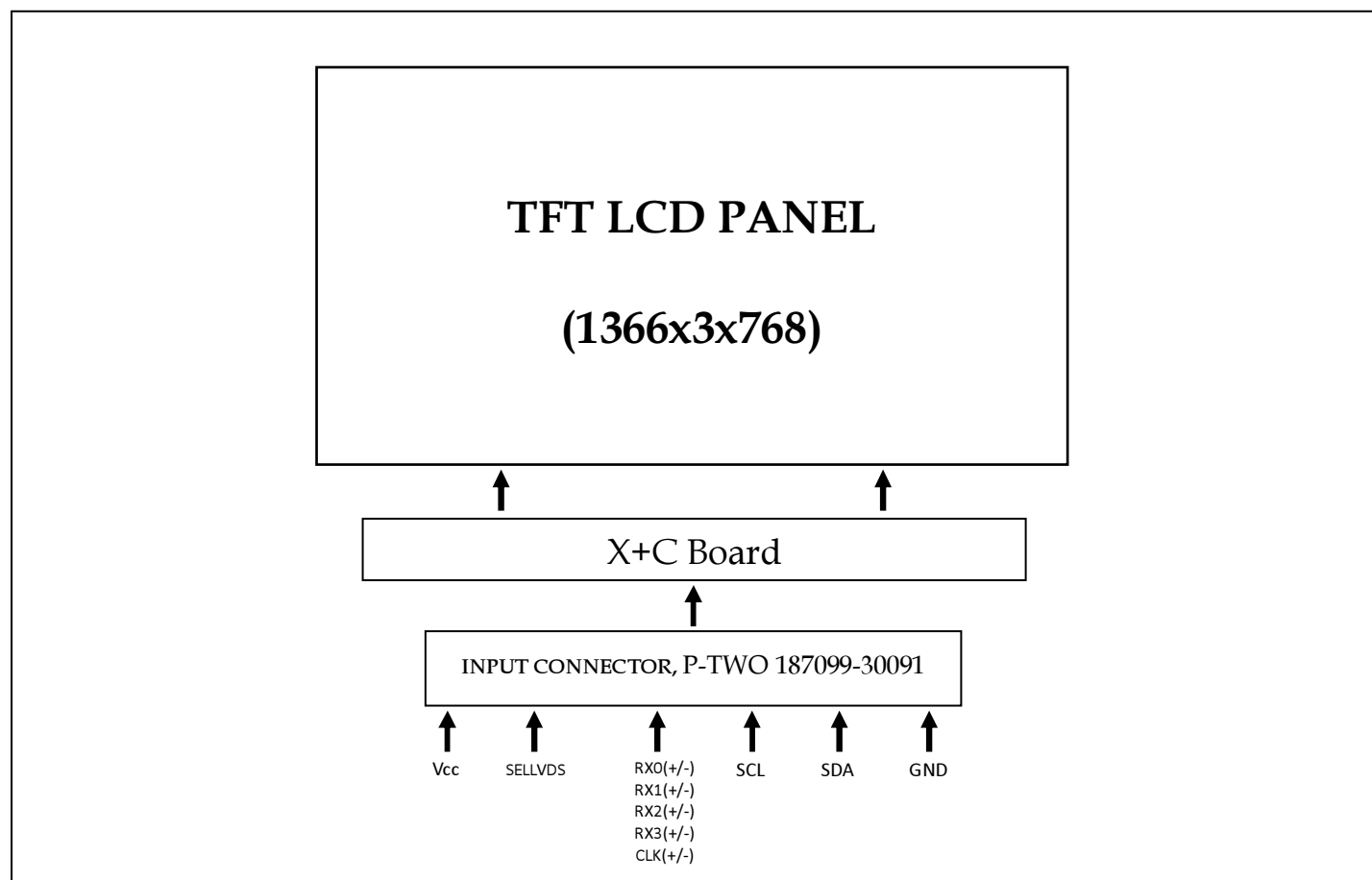


Note (4) The LVDS input characteristics are as follows :



#### 4. INPUT TERMINAL PIN ASSIGNMENT

##### 4.1 TFT LCD OPEN CELL



## 5. INPUT TERMINAL PIN ASSIGNMENT

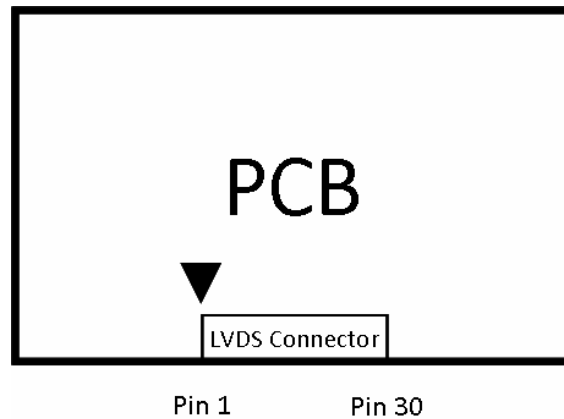
### 5.1 TFT LCD OPEN CELL INPUT

CNF1 Connector Pin Assignment (P-TWO 187099-30091)

| Pin | Name    | Description                           | Note   |
|-----|---------|---------------------------------------|--------|
| 1   | VCC     | Power supply: +12V                    |        |
| 2   | VCC     | Power supply: +12V                    |        |
| 3   | VCC     | Power supply: +12V                    |        |
| 4   | VCC     | Power supply: +12V                    |        |
| 5   | GND     | Ground                                |        |
| 6   | GND     | Ground                                |        |
| 7   | GND     | Ground                                |        |
| 8   | NC      | No Connection                         | (2)    |
| 9   | SELLVDS | LVDS data format Selection            | (3)(4) |
| 10  | NC      | No connection                         | (2)    |
| 11  | GND     | Ground                                |        |
| 12  | RX0-    | Negative transmission data of pixel 0 |        |
| 13  | RX0+    | Positive transmission data of pixel 0 |        |
| 14  | GND     | Ground                                |        |
| 15  | RX1-    | Negative transmission data of pixel 1 |        |
| 16  | RX1+    | Positive transmission data of pixel 1 |        |
| 17  | GND     | Ground                                |        |
| 18  | RX2-    | Negative transmission data of pixel 2 |        |
| 19  | RX2+    | Positive transmission data of pixel 2 |        |
| 20  | GND     | Ground                                |        |
| 21  | RXCLK-  | Negative of clock                     |        |
| 22  | RXCLK+  | Positive of clock                     |        |
| 23  | GND     | Ground                                |        |
| 24  | RX3-    | Negative transmission data of pixel 3 |        |
| 25  | RX3+    | Positive transmission data of pixel 3 |        |
| 26  | GND     | Ground                                |        |
| 27  | NC      | No connection                         | (2)    |
| 28  | SCL     | I2C clock (For Vcom tuning)           |        |
| 29  | SDA     | I2C data (For Vcom tuning)            |        |
| 30  | GND     | Ground                                |        |

Note (1) Connector type: P-TWO 187099-30091

LVDS connector pin order defined as follows



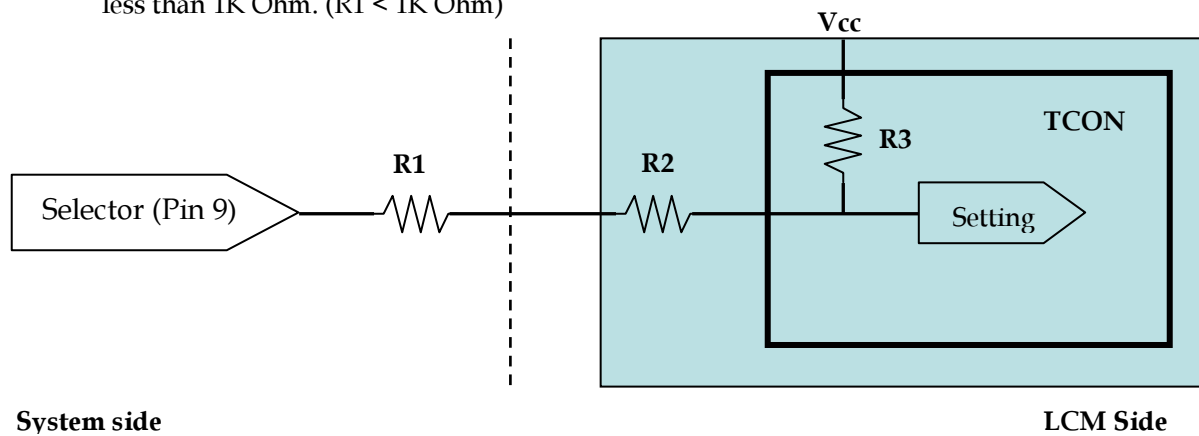
Note (2) Reserved for internal use. Please leave it open.

Note (3) Connect to Open or +3.3V: VESA Format, connect to GND: JEIDA Format.

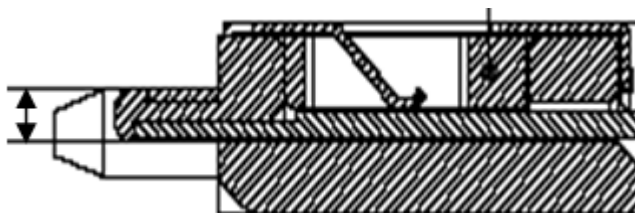
| SELLVDS    | Mode  |
|------------|-------|
| H(default) | VESA  |
| L          | JEIDA |

L: Connect to GND, H: Connect to +3.3V

Note (4) LVDS signal pin connected to the LCM side has the following diagram. R1 in the system side should be less than 1K Ohm. ( $R1 < 1K \text{ Ohm}$ )



Note (5) LVDS connector mating dimension range request is 0.93mm~1.0mm as follow



Note (6) The screw hole which is distant from the connector is merged with Ground

## 5.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

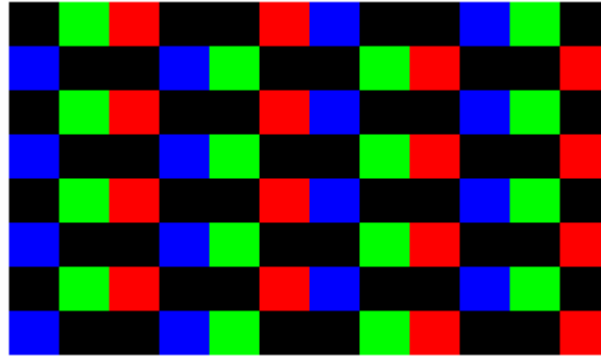
| Color               |                  | Data Signal |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    |
|---------------------|------------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
|                     |                  | Red         |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    | Blue |    |    |    |    |    |    |    |
|                     |                  | R7          | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7    | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7   | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors        | Black            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                     | Yellow           | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | White            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red (0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (2)          | 0           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Red (253)        | 1           | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (254)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Red (255)        | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Green | Green (0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Green (253)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (254)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Green (255)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Blue  | Blue (0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                     | Blue (1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
|                     | Blue (2)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  |
|                     | Blue (253)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 0  | 1  |
|                     | Blue (254)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 0  |
|                     | Blue (255)       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

### 5.3 FLICKER (Vcom) ADJUSTMENT

#### (1) Adjustment Pattern:

The adjustment pattern is shown as below. If customer needs below pattern, please directly contact with CMI account FAE.



#### (2) Adjustment method: (Digital V-com)

Programmable memory IC is used for Digital V-com adjustment in this model. CMI provide Auto Vcom tools to adjust Digital V-com. The detail connection and setting instruction, please directly contact with Account FAE or refer CMI Auto V-com adjustment OI. Below items is suggested to be ready before Digital V-com adjustment in customer LCM line.

- a. USB Sensor Board.
- b. Programmable software.
- c. Document: Auto V-com adjustment suggestion OI.



## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

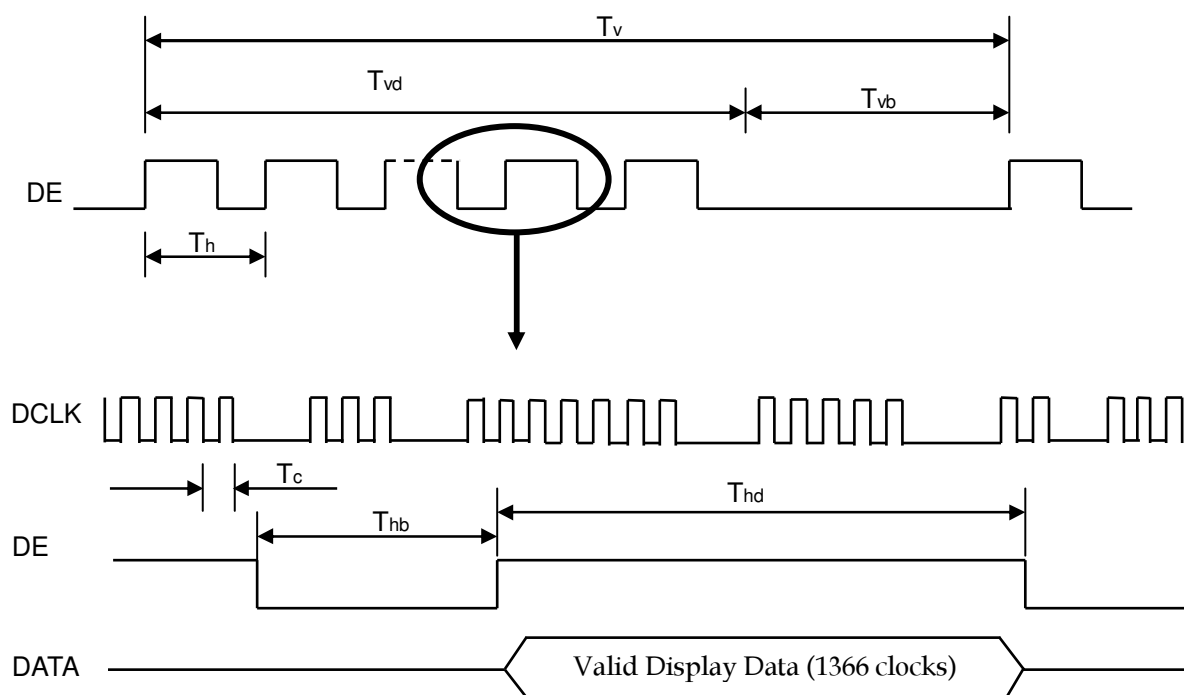
| Signal                         | Item                                 | Symbol                        | Min.               | Typ. | Max.               | Unit  | Note                |
|--------------------------------|--------------------------------------|-------------------------------|--------------------|------|--------------------|-------|---------------------|
| LVDS Receiver Clock            | Frequency                            | $F_{clk_{in}}$<br>( $=1/TC$ ) | 60                 | 76   | 82                 | MHz   |                     |
|                                | Input cycle to cycle jitter          | $T_{rcl}$                     | -                  | —    | 200                | ps    | (3)                 |
|                                | Spread spectrum modulation range     | $F_{clk_{in\_mod}}$           | $F_{clk_{in}}-2\%$ | —    | $F_{clk_{in}}+2\%$ | MHz   | (4)                 |
|                                | Spread spectrum modulation frequency | $F_{SSM}$                     | —                  | —    | 200                | KHz   |                     |
| LVDS Receiver Data             | Receiver Skew Margin                 | $T_{RSKM}$                    | -400               | —    | 400                | ps    | (5)                 |
| Vertical Active Display Term   | Frame Rate                           | $F_{r5}$                      | 47                 | 50   | 53                 | Hz    | (6)                 |
|                                |                                      | $F_{r6}$                      | 57                 | 60   | 63                 | Hz    |                     |
|                                | Total                                | $T_v$                         | 778                | 806  | 986                | Th    | $T_v=T_{vd}+T_{vb}$ |
|                                | Display                              | $T_{vd}$                      | 768                | 768  | 768                | Th    | —                   |
|                                | Blank                                | $T_{vb}$                      | 10                 | 38   | 218                | Th    | —                   |
| Horizontal Active Display Term | Total                                | $T_h$                         | 1446               | 1560 | 1936               | $T_c$ | $T_h=T_{hd}+T_{hb}$ |
|                                | Display                              | $T_{hd}$                      | 1366               | 1366 | 1366               | $T_c$ | —                   |
|                                | Blank                                | $T_{hb}$                      | 80                 | 194  | 570                | $T_c$ | —                   |

Note (1) Please make sure the range of pixel clock has follow the below equation :

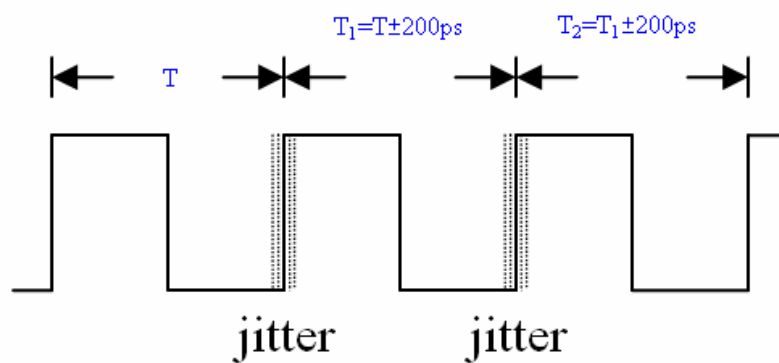
$$F_{clk_{in}(max)} \geq F_{r6} \times T_v \times T_h$$

$$F_{r5} \times T_v \times T_h \geq F_{clk_{in}(min)}$$

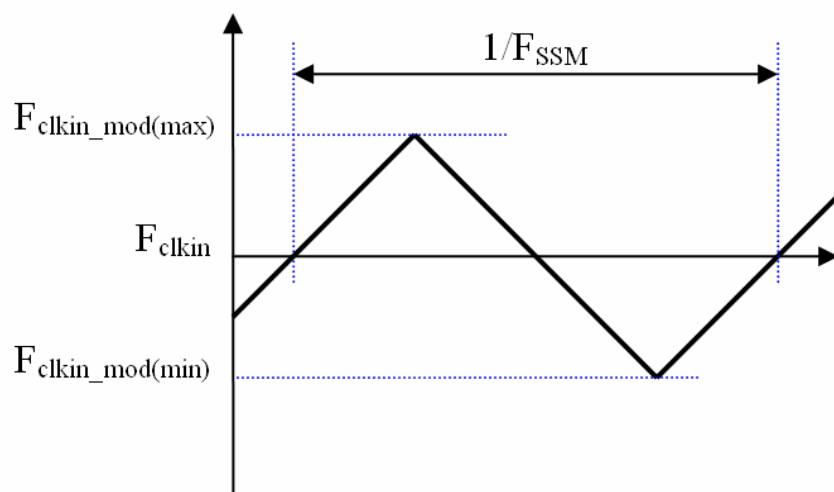
Note (2) This module is operated in DE only mode and please follow the input signal timing diagram below :



Note (3) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T_1 - T|$

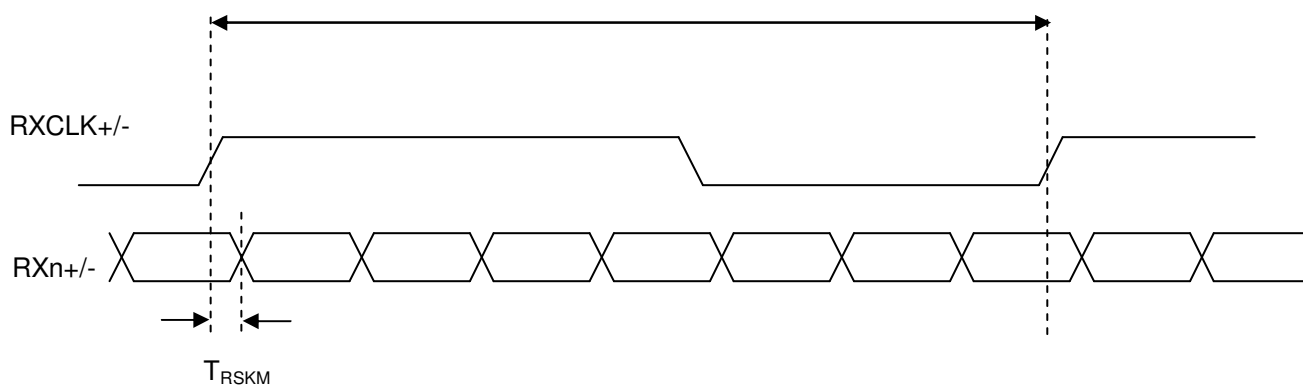


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



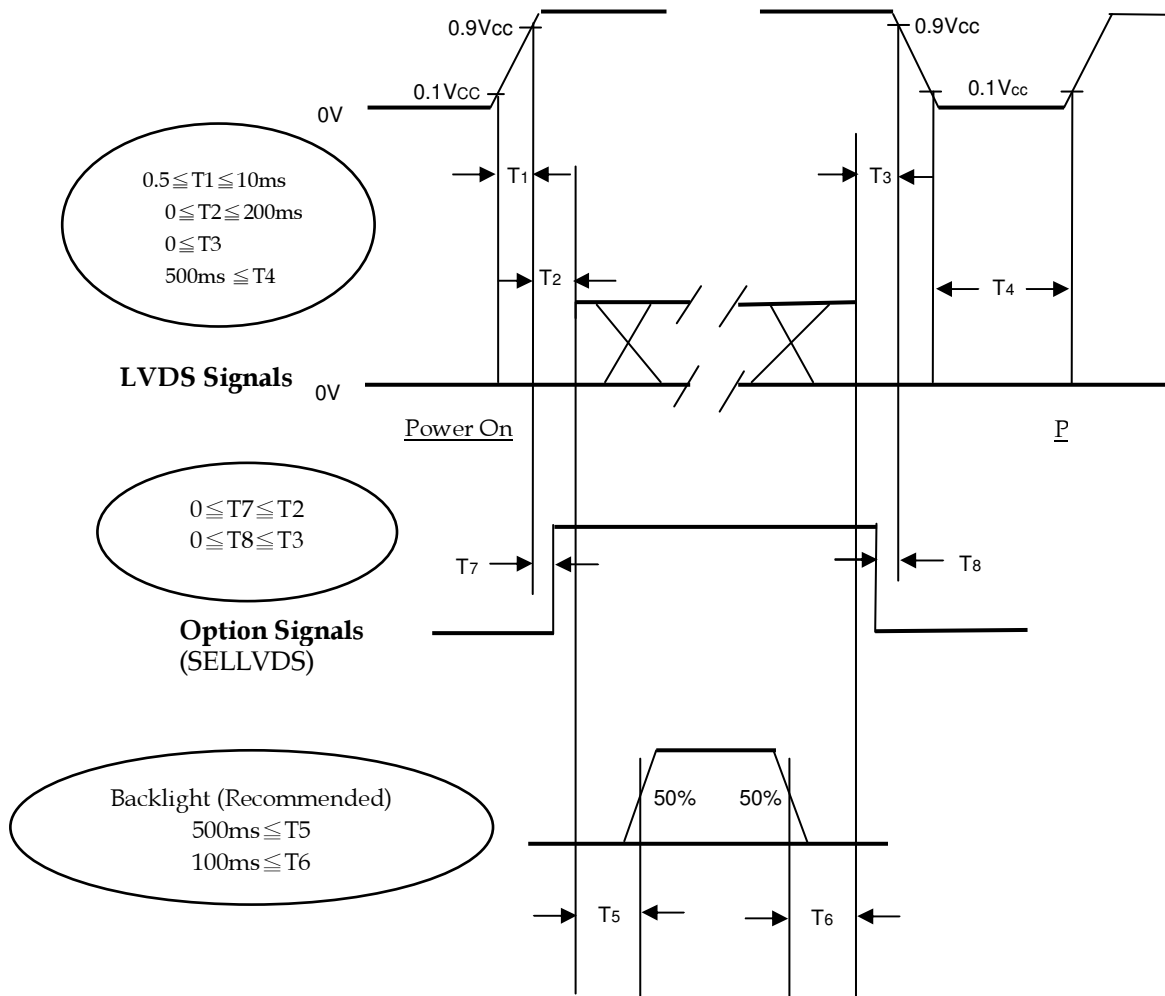
Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

#### LVDS RECEIVER INTERFACE TIMING DIAGRAM



## 6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Note (1) The supply voltage of the external system for the module input should follow the definition of V<sub>CC</sub>.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of V<sub>CC</sub> is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

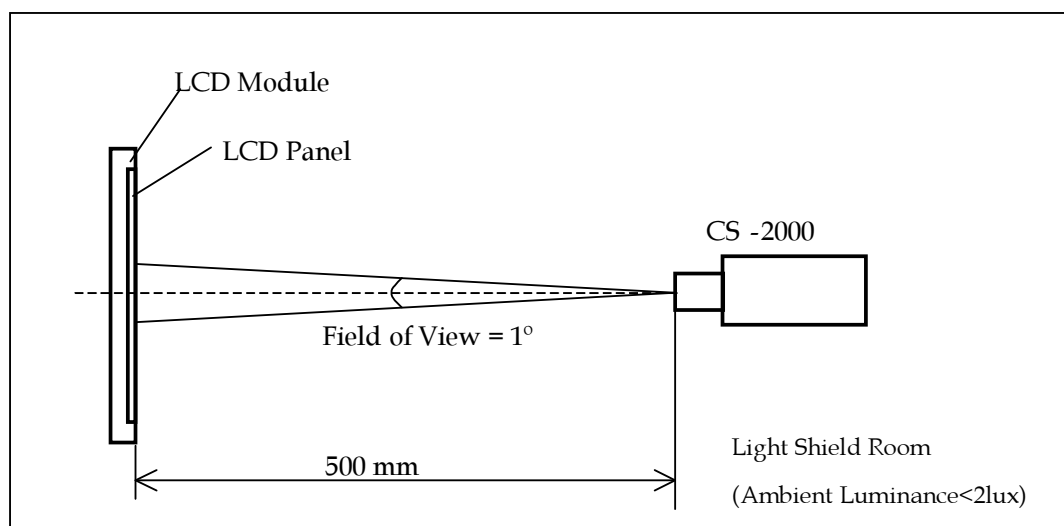
Note (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                | Symbol                                                        | Value     | Unit |
|---------------------|---------------------------------------------------------------|-----------|------|
| Ambient Temperature | Ta                                                            | 25±2      | °C   |
| Ambient Humidity    | Ha                                                            | 50±10     | %RH  |
| Vertical Frame Rate | Fr                                                            | 60        | Hz   |
| Supply Voltage      | V <sub>CC</sub>                                               | 12.0±1.2  | V    |
| Input Signal        | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |           |      |
| LED Current         | I <sub>L</sub>                                                | 160 ± 4.8 | mA   |

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring in a windless room.



## 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 7.1 and stable environment shown in 7.1.

| Item                    |            | Symbol        | Condition                                                                                              | Min.  | Typ.  | Max.  | Unit | Note    |
|-------------------------|------------|---------------|--------------------------------------------------------------------------------------------------------|-------|-------|-------|------|---------|
| Color Chromaticity      | Red        | Rcx           | $\theta_x=0^\circ, \theta_Y=0^\circ$<br>Viewing Angle at Normal Direction<br>Standard light source “C” | -0.03 | 0.650 | +0.03 | -    | (0)     |
|                         |            | Rcy           |                                                                                                        |       | 0.328 |       | -    |         |
|                         | Green      | Gcx           |                                                                                                        |       | 0.277 |       | -    |         |
|                         |            | Gcy           |                                                                                                        |       | 0.596 |       | -    |         |
|                         | Blue       | Bcx           |                                                                                                        |       | 0.132 |       | -    |         |
|                         |            | Bcy           |                                                                                                        |       | 0.115 |       | -    |         |
|                         | White      | Wcx           |                                                                                                        |       | 0.299 |       | -    |         |
|                         |            | Wcy           |                                                                                                        |       | 0.353 |       | -    |         |
| Center Transmittance    |            | T%            | $\theta_x=0^\circ, \theta_Y=0^\circ$<br>With CMI Module@60Hz                                           | -     | 5.4   | -     | %    | (1),(5) |
| Transmittance Variation |            | $\delta T$    |                                                                                                        |       |       | 1.3   |      | (1),(5) |
| Contrast Ratio          |            | CR            |                                                                                                        | 2100  | 3000  | -     | -    | (1),(3) |
| Response Time           |            | Gray to gray  |                                                                                                        | -     | 9.5   | 18    | ms   | (1),(4) |
| Viewing Angle           | Horizontal | $\theta_{x+}$ | CR $\geq$ 20<br><br>With CMI Module                                                                    | -     | 88    | -     | Deg. | (1),(2) |
|                         |            | $\theta_{x-}$ |                                                                                                        | -     | 88    | -     |      |         |
|                         | Vertical   | $\theta_{Y+}$ |                                                                                                        | -     | 88    | -     |      |         |
|                         |            | $\theta_{Y-}$ |                                                                                                        | -     | 88    | -     |      |         |

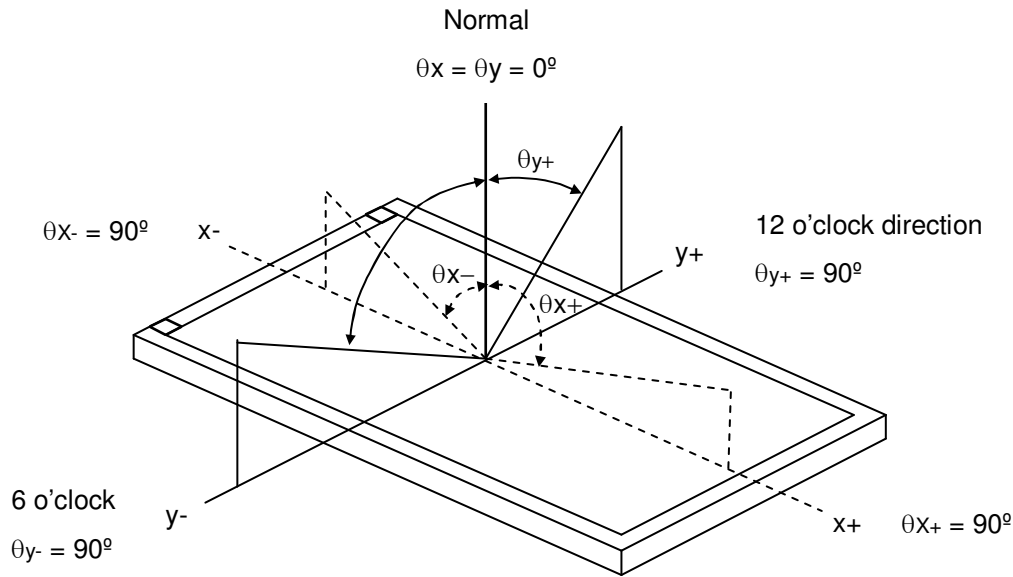
Note (0) Light source is the standard light source "C" which is defined by CIE and driving voltage are based on suitable gamma voltages. The calculating method is as following :

- 1.Measure Module's and BLU's spectrum at center point. W, R,G, B are with signal input. BLU (V290BJ1-LE1) is supplied by CMI.
- 2.Calculate cell's spectrum.
- 3.Calculate cell's chromaticity by using the spectrum of standard light source "C".

Note (1) Light source is the BLU which supplied by CMI and driving voltage are based on suitable gamma voltages.

Note (2) Definition of Viewing Angle ( $\theta_x, \theta_y$ ) :

Viewing angles are measured by Autronic Conoscope Cono-80 (or Eldim EZ-Contrast 160R )



Note (3) Definition of Contrast Ratio (CR) :

The contrast ratio can be calculated by the following expression.

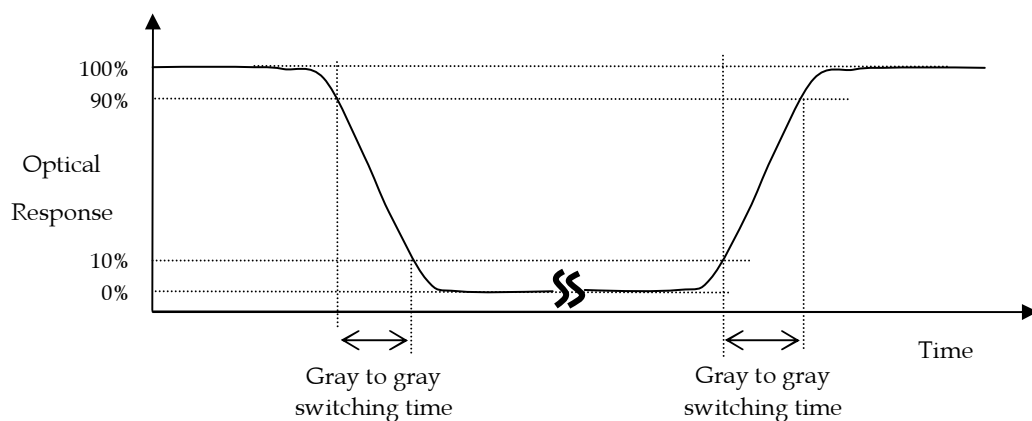
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L255}}{\text{Surface Luminance of L0}}$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

Note (4) Definition of Gray-to-Gray Switching Time :



The driving signal means the signal of gray level 0, 31, 63, 95, 127, 159, 191, 223 and 255. Gray to gray average time means the average switching time of gray level 0, 31, 63, 95, 127, 159, 191, 223 and 255 to each other.

Note (5) Definition of Transmittance (T%) :

Measure the luminance of gray level 255 at 5 points of LCD module.

$$\text{Transmittance (T\%)} = \frac{\text{average [L (1), L (2), L (3), L (4), L (5)] of LCD module}}{\text{average [L (1), L (2), L (3), L (4), L (5)] of backligh unit}} \times 100\%$$

The 5 point is corresponding of the point X at the figure in Note (6).

Note (6) Definition of Transmittance Variation ( $\delta T$ ) :

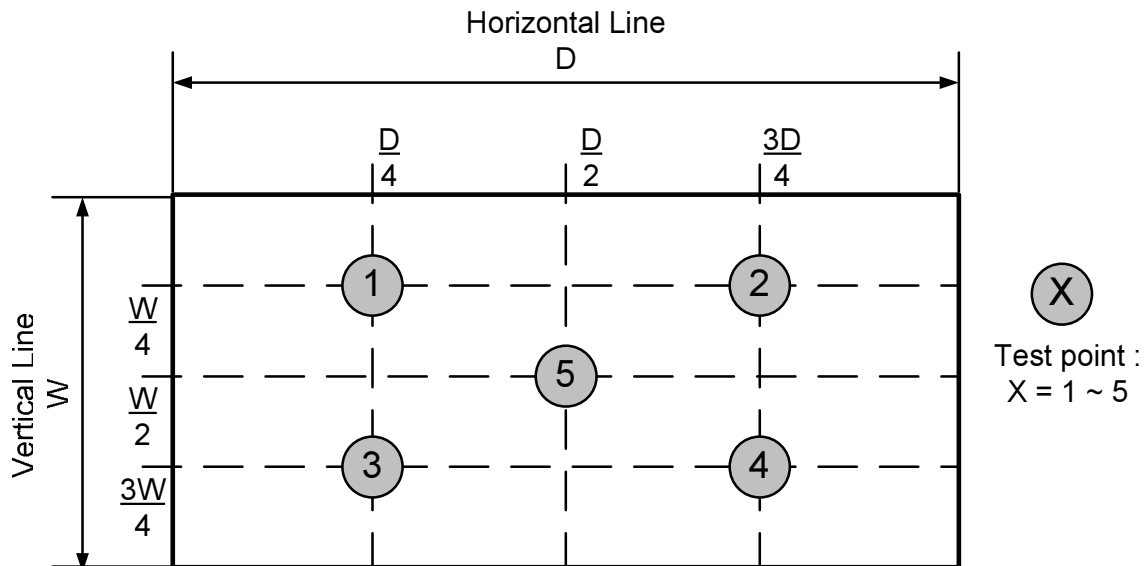
Measure the transmittance at 5 points.

The transmittance of each point can be calculated by the following expression.

$$T(X) = L_{255}(X) \text{ of LCD module} / L(X) \text{ of blackunit.}$$

L255: Luminance of gray level 255

$$\text{Transmittance Variation } (\delta T) = \frac{\text{Maximum [T (1), T (2), T (3), T (4), T (5)]}}{\text{Minimum [T (1), T (2), T (3), T (4), T (5)]}}$$





## 8. PRECAUTIONS

### 8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- [ 1 ] Do not apply rough force such as bending or twisting to the module during assembly.
- [ 2 ] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- [ 3 ] Do not apply pressure or impulse to the module to prevent the damage of LCD panel.
- [ 4 ] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- [ 5 ] The distance between COF edge and rib of BLU is suggested to be larger than 5mm, in order to prevent from damage on COF during module assembly.
- [ 6 ] Do not design sharp-pointed structure / parting line / tooling gate on the COF position of plastic parts, because the burr will scrape the COF.
- [ 7 ] If COF would be bended during module assembly, it is suggested not to locate the IC on the bending corner of COF.
- [ 8 ] The gap between COF IC and any structure of BLU is suggested to be larger than 2mm, in order to prevent from damage on COF IC.
- [ 9 ] Bezel opening must have no burr. Burr will scrape the panel surface.
- [ 10 ] It is suggested that bezel of module and bezel of TV set can not press or touch the panel surface. It will make light leakage or scrape.
- [ 11 ] When module used FFC / FPC, but no FFC / FPC to be attached in the open cell. Customer can refer the FFC / FPC drawing and buy it by self.
- [ 12 ] The gap between Panel and any structure of Bezel is suggested to be larger than 2mm, in order to prevent from damage on Panel.
- [ 13 ] Do not plug in or pull out the I/F connector while the module is in operation.
- [ 14 ] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- [ 15 ] Moisture can easily penetrate into LCD module and may cause the damage during operation.
- [ 16 ] When storing modules as spares for a long time, the following precaution is necessary.
  - [ 16.1 ] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C at normal humidity without condensation.
  - [ 16.2 ] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.
- [ 17 ] When ambient temperature is lower than 10°C, the display quality might be reduced.
- [ 18 ] The peeling strength of COF is 200gf/cm.
- [ 19 ] During module assembly process, the static electricity around the environment should be less than 300V.

## 8.2 SAFETY PRECAUTIONS

- [ 1 ] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- [ 2 ] After end of life of the open cell product, it is not harmful in case of normal operation and storage.

## 9. DEFINITION OF LABELS

### 9.1 OPEN CELL LABEL

The barcode nameplate is pasted on each open cell as illustration for CMI internal control.

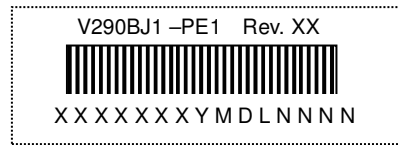
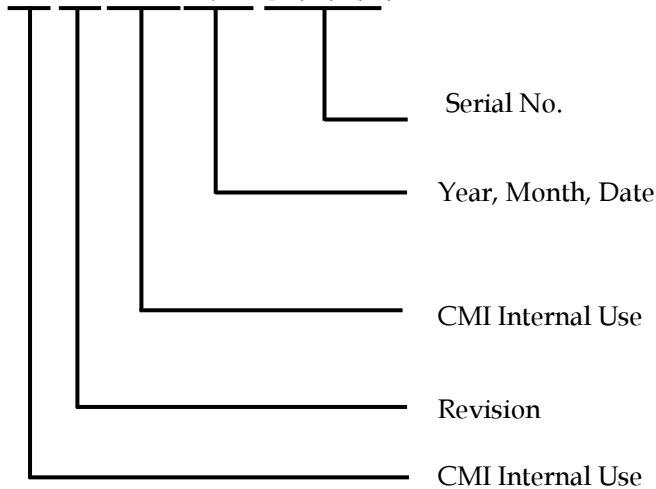


Figure.9-1 Serial No. Label on SPWB and Cell

Model Name: V290BJ1-PE1

Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

Manufactured Date:

Year: 2010=0, 2011=1, 2012=2...etc.

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

Revision Code: Cover all the change

Serial No.: Manufacturing sequence of product

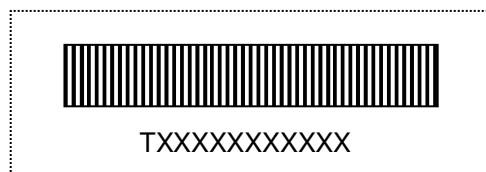
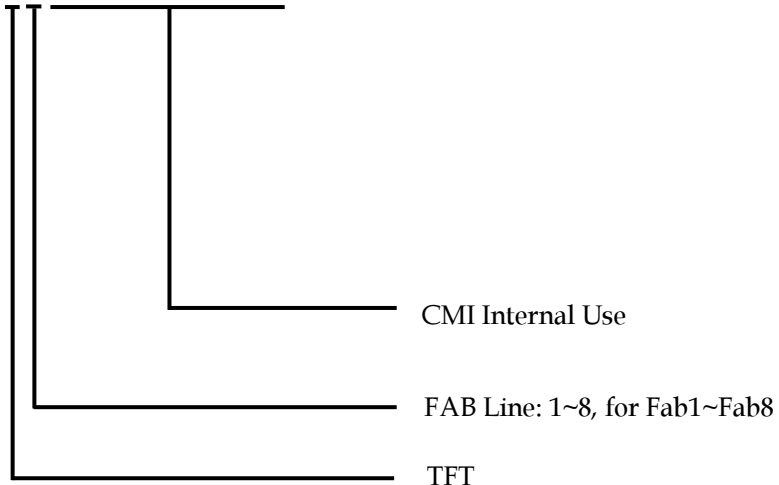


Figure.9-2 Panel ID Label on Cell

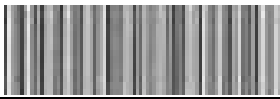
Panel ID Label includes the information as below :

Panel ID: T X X X X X X X X X



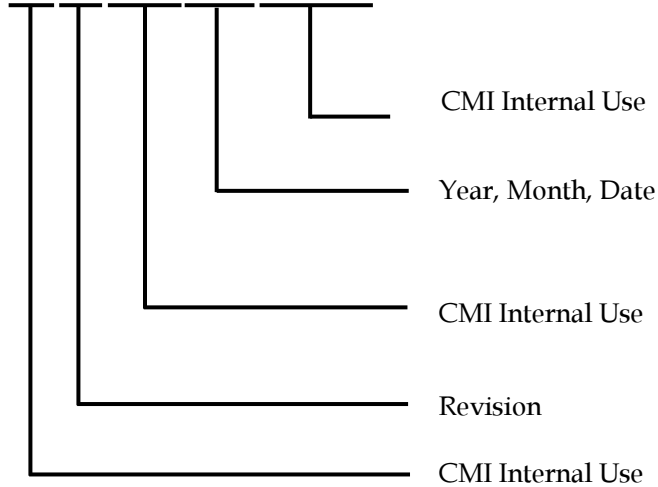
## 9.2 CARTON LABEL

The barcode nameplate is pasted on each box as illustration, and its definitions are as following explanation.

|                                |                                                                                                       |
|--------------------------------|-------------------------------------------------------------------------------------------------------|
| RoHS                           |                                                                                                       |
| P.O. NO.                       | _____                                                                                                 |
| Parts ID.                      | _____                                                                                                 |
| Model Name                     | V290BJ1-PE1                                                                                           |
| Carton ID.                     | <br>XXXXXXXXXXXXXXXX |
| Quantities                     | _____                                                                                                 |
| Made In Taiwan (Made In China) |                                                                                                       |

(a) Model Name: V290BJ1- PE1

(b) Carton ID: X X X X X X Y M D X X X X



Serial ID includes the information as below :

Manufactured Date:

Year: 2010=0, 2011=1, 2012=2...etc.

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

Revision Code: Cover all the change

## 10. PACKAGING

### 10.1 PACKAGING SPECIFICATIONS

Tray :

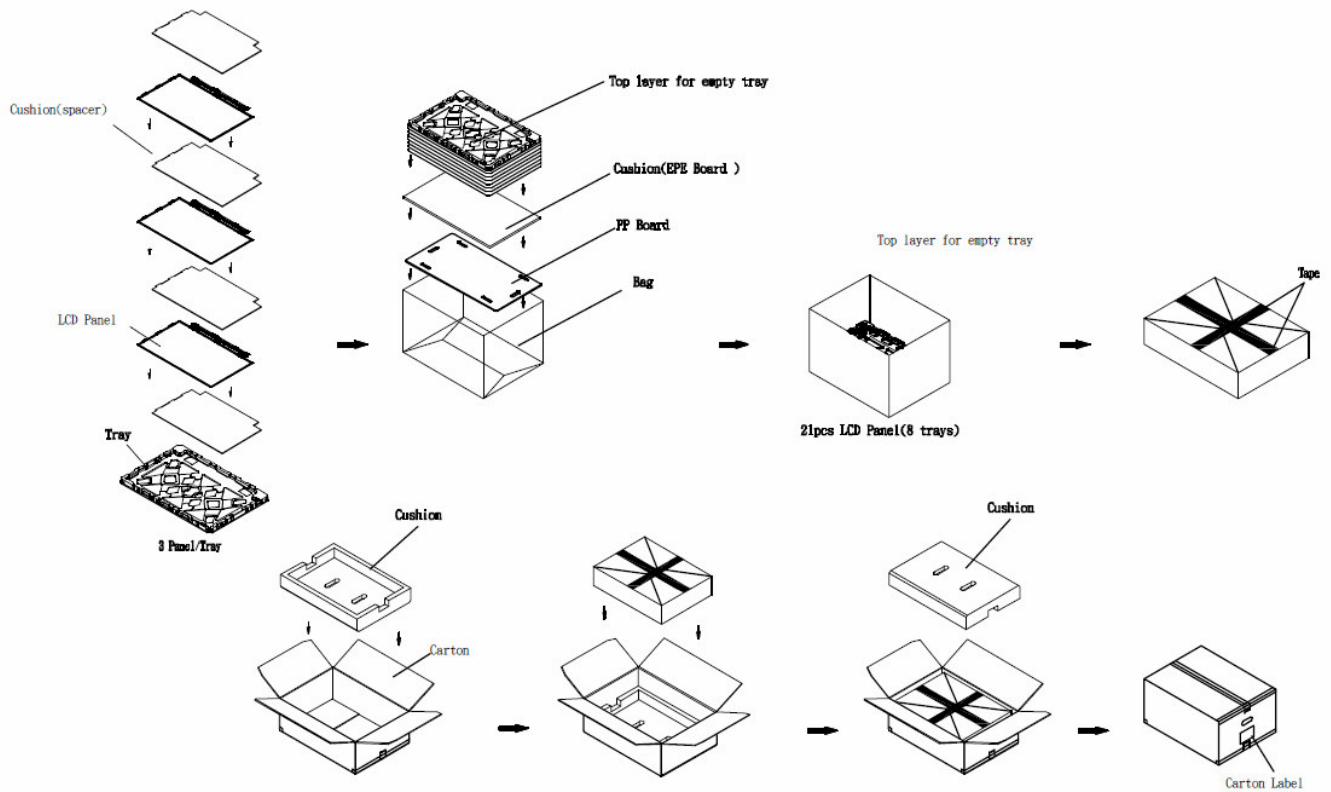
- (1) 21 PCS LCD TV Panels / 1 Box
- (2) Box dimensions : 812(L) X 572(W) X 277(H)mm
- (3) Weight : approximately 22 Kg

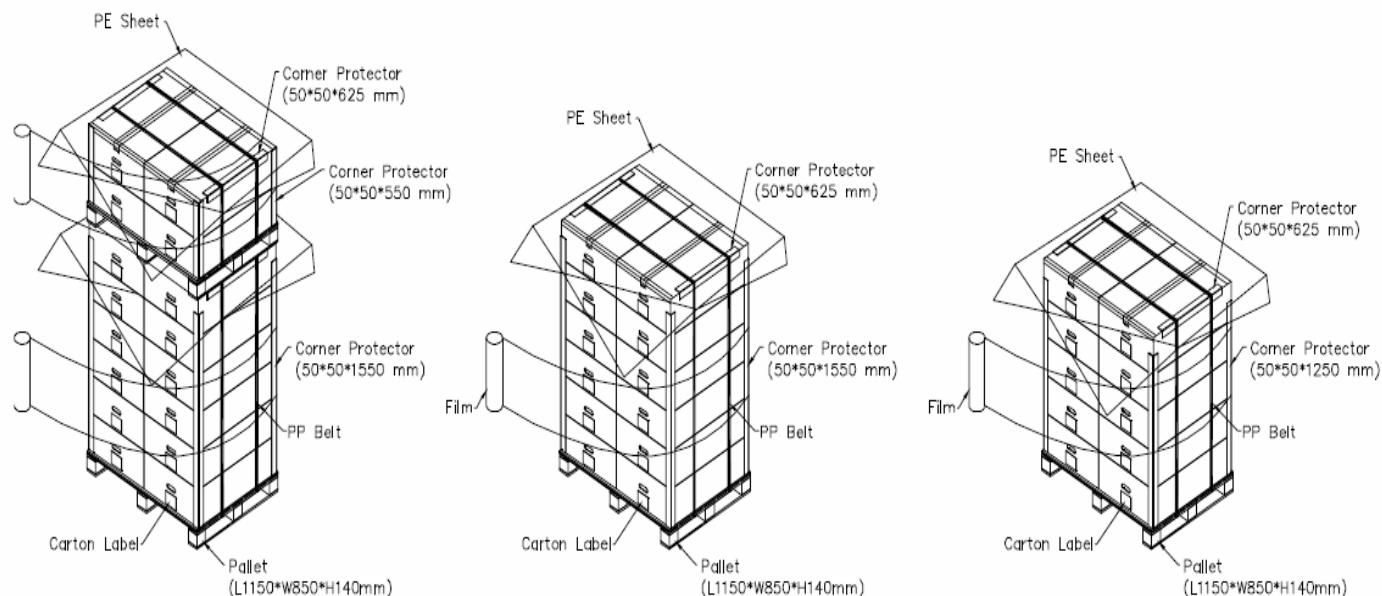
Hard Box :

- (4) 20 PCS LCD TV Panels / 1 Box
- (5) Box dimensions : 740(L) X 510(W) X103 (H)mm
- (6) Weight : approximately 18 Kg

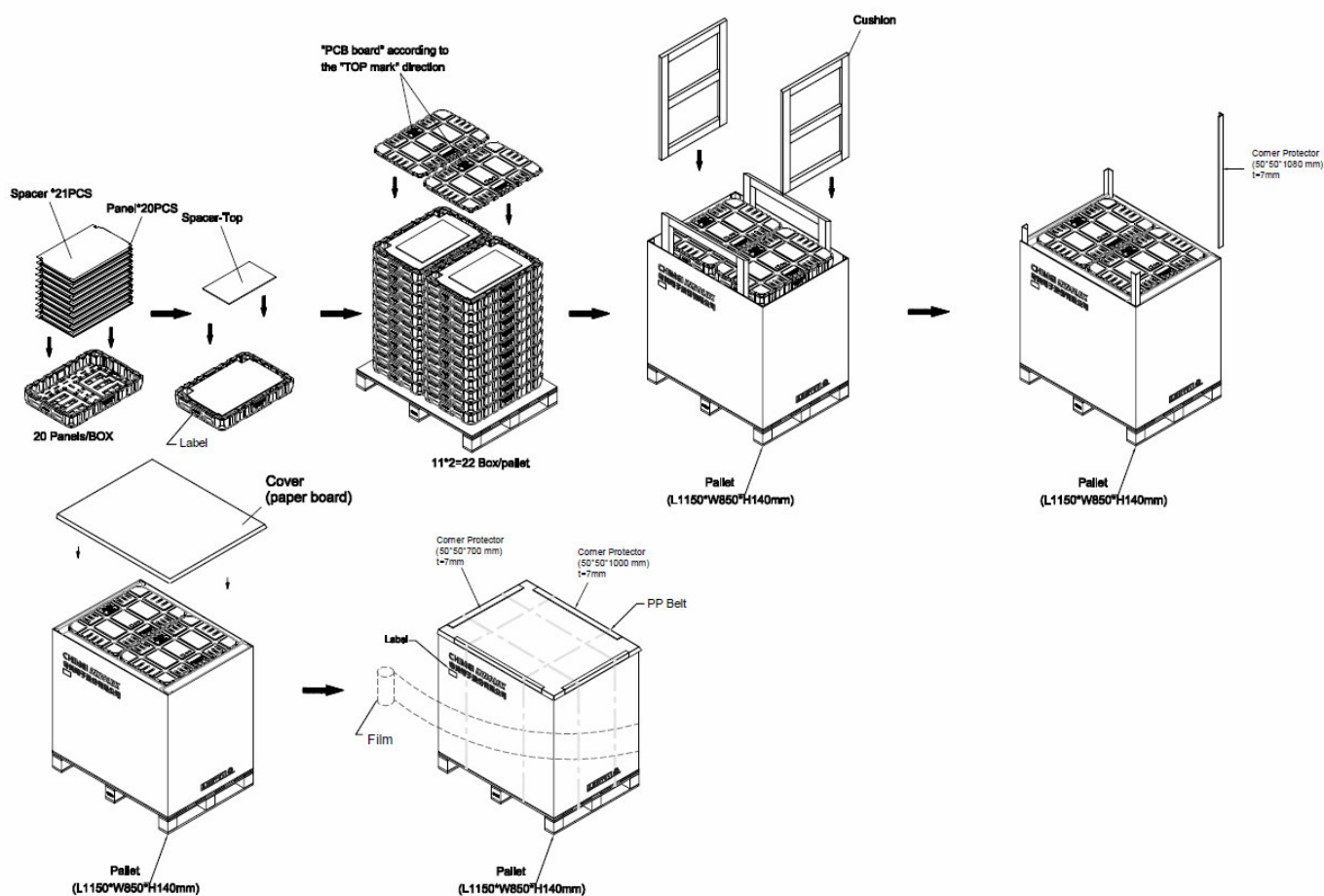
### 10.2 PACKAGING METHOD

Packing method (Tray) is shown in following figures.

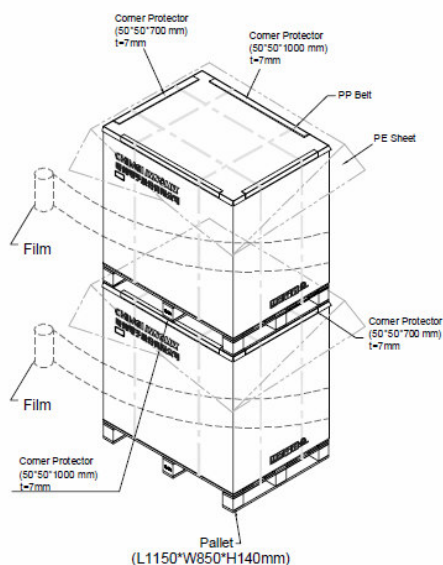




Packing method (Hard Box) is shown in following figures.

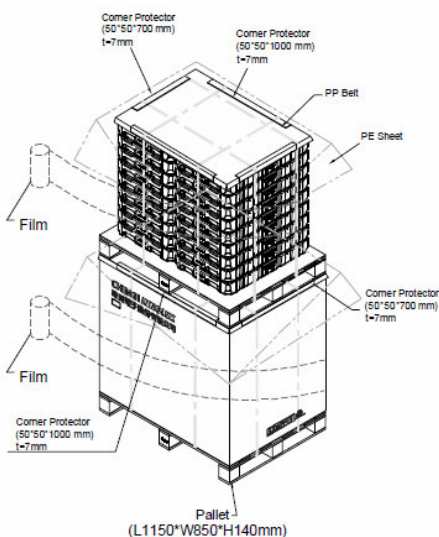


Sea&Land Transportation  
(40ft HQ Container)



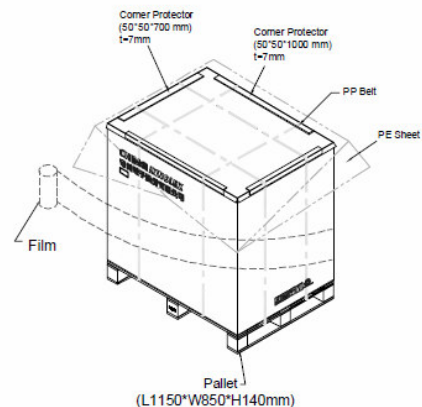
22 Box / Pallet + 22 Box / Pallet

Sea / Land Transportation



22Box / Pallet + 18Box / Pallet

Air Transportation



22 Box / Pallet



## 11. MECHANICAL CHARACTERISTIC

